these methods have become stereotyped. But the late Mr. Stirling, as an engineer, had to think for himself, and, moreover, his occupation removed him to places far from the busy crowd. He could scarcely have had the opportunity of examining and testing his opinions by comparison with those of others who have been differently trained, for he passed much of his life in furthering railway enterprise in Chili and Peru. There he was free to follow the lines of thought that his uncurbed fancies suggested. His book is therefore marked with much freshness, but also with some errors. In many respects it is interesting, since it shows the confusion which an intelligent mind may create for itself when it disregards the trammels of authority and attacks problems for the study of which it is not fitted by previous training.

We get the first insight into this mutinous disregard for authority when we find our author describing, in his first chapter, the experiments which the late Sir George Airy carried out at the Harton Colliery. It cannot be denied but that these experiments are open to some objection, though possibly not entirely on the grounds on which the author insists. But there is a certain refreshing keenness in his criticism which one can read and enjoy. We next find our author hopelessly blundering over that terrible question of the moon's rotation, and we cannot help thinking that the late Mr. Stirling must have had in his nature a considerable spice of obstinacy. He was far too intelligent not to have recognised the true character of the problem and to have found its solution. It is to be regretted, perhaps, that he did not rely upon his own good sense, and that he consulted so many authorities. He has our sympathy to the extent that these authorities have not always expressed themselves with clearness, and in some cases not even with accuracy. But with perverted ingenuity he seems to have fastened upon any looseness of expression he could find, and has endeavoured to give it a construction that it will not legitimately bear. But when we find the centrifugal force due to the moon's rotation introduced as a cause to explain the transference of air and water from the visible hemisphere of the moon to the hemisphere that we do not see, we are disposed to give up our author as incorrigible. It is not at all surprising after this that he should turn his attention to the nebular hypothesis, that he should find its explanation inadequate, and to need some finishing touches which he is ready to supply. For this is a subject that attracts those most keenly who are least qualified to handle it intelligently. Unfettered by close reasoning and unfamiliar with the bearing of material facts and deductions, they lose themselves in apparently plausible intricacies, and hopelessly puzzle those who attempt to follow them.

W. E. P.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. H. W. Marett Tims, of King's College, demonstrator of anatomy in the University, has been appointed professor of biology at the Royal Veterinary College, London.

At a meeting of the president and fellows of Queens', held on Wednesday, July 18, Prof. H. T. Bovey, F.R.S., professor of engineering in the University of Montreal, was elected an honorary fellow. Mr. Bovey was formerly a fellow of the society.

The master and fellows of Christ's College have elected Mr. Francis Darwin, foreign secretary to the Royal Society, honorary fellow. Mr. Darwin for many years held the readership of botany in the University and a fellowship at Christ's. Dr. G. H. F. Nuttall, F.R.S., has been elected a fellow of the same college. Dr. Nuttall has held teaching posts at the Johns Hopkins University, Baltimore, and at the University of Berlin. He is at present reader in hygiene at Cambridge and chief editor of the *Journal of Hygiene*, which he largely helped to found.

DR. G. C. BOURNE has been appointed Linacre professor of comparative anatomy at Oxford, in succession to the late Prof. Weldon.

A CLASS in experimental psychology, including practical work and demonstrations, will be held by Prof. C. S. Myers on Saturdays in the psychological laboratory of King's College, London, beginning on October 6.

MR. V. H. BLACKMAN has been appointed lecturer in plant cytology in the department of botany of University College, London. In view of the new relationship between the college and the University of London, and in order to avoid confusion with the principal of the University of London, the title of the Principal of University College will be changed to that of Provost of University College.

MR. CLARENCE H. MACKAY and Mrs. John W. Mackay have given 20,000*l.* to the University of California, to endow the chair of electrical engineering. It will be known, says *Science*, as the John W. Mackay, jun., professorship, in memory of Mr. Mackay's brother, and will be filled by Prof. C. L. Cory, head of the department of mechanical and electrical engineering.

THE Board of Education has issued its instructions for the year August 1, 1906, to July 31, 1907, to technical schools, schools of art, and other day and evening schools and classes for further education. As is becoming common in the Board's publications, the volume begins with a prefatory memorandum, and in it great stress is laid upon the value to the student of science and technology of what is commonly called "general" education. Steps are detailed by which the Board proposes to encourage this side of the work of these schools and classes. It is pointed out that the lower classes of a good evening school afford to pupils, who have just left an elementary school, both a continuation of their general training and instruction in the application of that training to matters that come before them in their daily work. It is where, says the memorandum, this double aspect of evening schools is best developed, and where the lower and higher classes are most fully knit together, that the best records of attendance and of real progress are to be found. A distinct advance is recorded, we are glad to find, in the preliminary education of students entering higher classes in day technical schools, and this is to be traced to more efficient evening continuation schools. These regulations also make provision for an inclusive grant to local education authorities, other than London, in place of the separate grants assessed by taking into consideration the number of hours of instruction received by registered students in approved subjects. An authority wishing to receive such an inclusive grant must submit to the Board particulars of the manner in which it is proposed to make provision for the educational needs of the area and for the coordination of the several types and grades of this instruction with the other forms of education available for the area. All such endeavours to prevent overlapping and duplication of educational facilities, and to bring about economy and efficiency, are welcome. It is to be hoped the new plan proposed by the Board will effect the object in view.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 21.—"The Transition from the Liquid to the Solid State and the Foam-structure of Matter." By Prof. G. **Quincke**, For.Mem.R.S.

On June 19, 1905, the author laid before the Royal Society the results of his researches on ice-formation and glacier-grains (see NATURE, September 28, 1905, vol. lxxii., p. 543). The further prosecution of these researches has shown that phenomena similar to those observed in the freezing of water occur in all bodies in nature, and are in agreement with the structure of metals as observed by the author and also by other investigators. Solid bodies, then, are never homogeneous, but always exhibit a foam-structure.

All liquids in nature resemble water in forming, as they cool, oily foam walls, which may be very thin and invisible. The shape and position of these foam walls become visible on freezing or thawing in the following ways:—(*a*) By fissures or fractures at the surface of the foam walls,

whenever the liquid contents of the foam cells contracted on solidification, or when the walls and the contents of the foam cells contracted differently as they cooled. (*b*) By the bounding surfaces of the doubly refracting crystals (glacier-grains), which are differently orientated in neighbouring foam cells. (*c*) On illumination with sunlight or electric light, or on warming, when the doubly refracting contents of the foam cells melt and are transformed into singly refracting liquid. (*d*) By lens-shaped masses, foam flakes or air bubbles, suspended in the foam walls. (*e*) By the furrows, or network of lines on the solidified surface formed by the intersection with that surface of the foam walls in the interior of the solidified mass. (*f*) By polishing or etching the natural or artificial surface, in cases when the walls and the contents of the foam cells differ in hardness or in the rapidity with which they are attacked by chemical reagents.

The surfaces of solidified drops of pure molten *metals* show a network of straight lines or arcs of circles (usually inclined to one another at 120° or 90°), or foam walls with embedded lens-shaped masses. This is so in the case of gold, silver, platinum, palladium, iridium, indium, copper, zinc, iron, nickel, cobalt, bismuth, sodium, potassium and mercury. Similar phenomena are to be observed on the surface of solidified drops of sulphur and selenium, or on the surface of carbon which has been distilled with the electric arc in a magnetic field, and deposited on the kathode.

The shapes of the bounding surfaces of molten metals, and the circular arcs in the network of lines on the surface of metals raised to red or white heat, show that these bounding surfaces must be regarded, not as they have hitherto been, viz. as crystalline faces, but as solidified oily foam walls, which, as in the glacier-grains of ice, enclose foam cells with contents differing from the walls. Just as the glacier-grains of ice run together and enlarge by the bursting of the foam walls, so also larger foam cells with fewer foam walls are formed in metals heated nearly to melting point.

Pure molten metals after solidification exhibit on artificial polished and etched surfaces a network of lines or foam cells (similar to the glacier-grains of ice), which are bounded by thin foam walls. These thin foam walls themselves contain still smaller foam cells, as is proved by the visible lens-shaped masses embedded in them, and the wave-like furrows on their surface, which are capable in reflected light of giving diffraction colours like mother-of-pearl. This foam structure of pure metals when solidified after fusion has been demonstrated in the case of bismuth, cadmium, cobalt, copper, gold, iron, indium, iridium, lead, manganese, mercury, nickel, palladium, platinum, potassium, rhodium, sodium, tin, and zinc.

Molten metals solidify on cooling to a liquid jelly, and later to a solid jelly. The walls and contents of the foam cells of such a jelly still consist of viscous liquid, *i.e.* the jelly itself is still liquid—like ice—at temperatures lower than the melting points of the respective metals. The welding of two pieces of metal corresponds to the running together of the cell walls and cell contents of two lumps of jelly, or the regelation of ice.

All the other substances in nature behave like these metals. The soft, plastic condition, which all bodies assume for a larger or smaller interval of temperature on the transition from the solid to the liquid state, proves the presence of jelly, *i.e.* of oily, visible or invisible foam walls, over this interval of temperature.

The heterogeneous oily liquid, which as solidification occurs becomes visible in all substances in nature in the form of thin foam walls of different surface tension, must also appear as a thin liquid skin on the surface of solidifying drops. This explains the variations in the measurements of the surface tension of molten metals and salts, and of liquids in general.

The walls and contents of the foam cells consist of heterogeneous substance. That foreign matter in very small quantities—1/1000000 per cent. and even less—does form oily layers and foam walls in pure liquids is proved by the author's observations on ice and benzene. Traces of foreign matter (gases, carbon, metals, &c.) too small to be shown in any other way are present even in the purest liquids, and are sufficient to explain the observed foam structure of all solidified substances in nature.

June 28.—"On the Ultra-violet Spectrum of Ytterbium." By Sir William **Crookes**, F.R.S.

The rare earth, ytterbia, was discovered in 1878 by Marignac (*Comptes rendus*, vol. lxxxvii., p. 578). In 1880 Nilson (*Ber.*, vol. xii., p. 554), in purifying Marignac's ytterbia, found that it contained another earth, which he named scandia. Cleve, and more recently his daughter Astrid Cleve, have worked much on ytterbia, and within the last few years M. Urbain has taken up the subject, and has succeeded in purifying ytterbia in larger quantities. During the author's own work on the fractionation of the rare earths he also has prepared and worked with ytterbia.

M. Urbain's ytterbia was prepared by the fractional crystallisation of the ethyl-sulphates of crude gadolinite earths (*Comptes rendus*, vol. cxxxii., p. 136). The subsequent separation is by the fusing nitrate method. This after twenty series of fusions gave in the least basic portions a mixture of ytterbia and thoria, which are easily separated by Wyrouboff and Verneuil's method.

The examination for absorption bands in a strong solution is a fairly good test for an earth such as erbia and thulia giving absorption spectra, but it is not so delicate as an examination of the spark spectrum photographed through a quartz train, for dominant lines, which most elements show in some part of their spectrum. For instance, the dominant lines of yttrium are at wave-lengths 3600·9, 3710·4, 3774·5, 4177·7, and 4375·1. The dominant lines of erbium are at 3499·3, 3692·8, and 3906·5. They are, however, not strong, and fortunately the absorption bands of this element are striking and characteristic. The spark spectrum of thulium has only been slightly examined by the author, and he does not think it has any strong lines. Its absorption spectrum, as with erbium, is a very characteristic one. The spark spectrum of ytterbium has strong dominant lines at 3289·5 and 3694·4. Scandium has dominant lines at 3572·7, 3614·0, 3630·9, 3642·9, and 4247·0.

The author's photographs were taken with the quartz apparatus already described, the spectrum of pure iron being used as a standard. The ytterbium spark was taken from a strong solution of the nitrate between platinum poles, sufficient self-induction being introduced to eliminate nearly all the air lines. The ytterbium, by this very severe spectrum test, is seen to be not absolutely free from impurities—thulium, copper, and calcium being present. Thulium is seen by its lines at 3020·7, 3131·4, 3425·2, 3441·6, 3462·4, and 3848·2. Copper is seen by its dominant lines at 3247·7 and 3274·1, and calcium by its dominant lines at 3933·8 and 3968·6.

The platinum lines which are present are easily recognised, and are useful as an additional measure of identification. Besides these, a number of fainter and indistinct lines are seen. These may be due to ytterbium or to traces of hitherto unrecognised impurities.

The wave-lengths of all the recognisable lines of ytterbium are given on the photograph, and also those of thulium, calcium, and copper, but the platinum lines are not marked.

PARIS.

Academy of Sciences, July 16.—M. H. Poincaré in th chair.—The absorption of nitrogen by organic substances, determined at a distance under the influence of radio-active materials: M. **Berthelot.** The action of air upon cellulose in the presence of a radium salt has been studied; the effects are comparable with those produced by the silent discharge.—A photometer specially designed for measuring the circumsolar light. Its use during the total eclipse of August 30, 1905: H. **Deslandres** and A. **Bernard.** The standard light used in the comparisons was a small osmium lamp. Two diagrams are given showing the arrangement of the photometer and telescope. The apparatus was used at Burgos during the last total eclipse, but the meteorological conditions were unfavourable.—Study of an apparatus designed by M. Lippmann for the photographic measurement of right ascensions: W.

Ebert and C. **Le Morvan.** A description of the modifications found necessary in the original apparatus, by means of which the error of a single point is less than 0·06s. The results are obviously free from personal error, and the deformations produced by the objective are eliminated, since the images of the stars and the slit fixing the meridian, being produced by the same lens, undergo the same deviations.—The rigorous determination of two instrumental constants which intervene in certain meridian observations: H. **Renan.** A method for determining the exact angular relations between the two cross wires of the micrometer and the plane of the telescope.—The arbitrary character of developments of solutions, even unique, of the problems of mathematical physics, and on new properties of generalised trigonometrical series: A. **Buhl.**—Measurements of wave-lengths in the iron spectrum for the establishment of a system of spectroscopic standards: Ch. **Fabry** and H. **Buisson.** The measurements were made photographically by the interference method, the green mercury line given by the Cooper-Hewitt lamp being used as a basis. The measurements given fall between λλ 3606·687 and 6494·994.—The photography of the infra-red rays: Walter **Ritz.** The author has subjected Abney's method of preparing sensitive collodion films to a critical examination, and gives details for the preparation of plates highly sensitive to the infra-red radiations. Photographs were taken of the spectrum from the blue decreasing regularly to 1·4 μ, none of the discontinuities inseparable from the use of colouring materials being apparent.—The reduction of molybdenum dioxide by boron, and the combination of boron with molybdenum: Binet **du Jassoneix.** Previous work on this subject has been vitiated by the use of carbon crucibles, the formation of carbides of molybdenum being unavoidable under these conditions. The author uses a magnesia boat, and readily obtains pure molybdenum by heating boron and molybdenum dioxide in the electric furnace. By increasing the proportion of boron, products, free from carbide, and containing up to 46 per cent. of boron, can be prepared. These are attacked by dilute nitric acid, and show no trace of crystalline structure.—The electrical conductivity of colloidal ferric chloride: G. **Malfitano.**—The influence of non-electrolytes on the mutual precipitation of colloids of opposite electrical sign: J. Larguier **des Bancels.**—The composition of an acetic ferment: E. **Alilaire.** Five grams of a very active mycoderma were obtained from a vinegar works, the conditions allowing of the production of a pure culture on the large scale. Alcohol extracted 1·56 per cent. of a fatty substance containing phosphorus, from which, after saponification with soda, potassium iodide gave iodocholine crystals. The substance thus freed from fat contained 6·9 per cent. of nitrogen and 5·9 per cent. of ash, the analysis of which is given. The presence of a considerable proportion of iron and copper in the ash is noteworthy, the latter metal, according to the author's views, playing an important part in the process of acetification.—The microlitic rocks collected in Grahamsland by Dr. Charcot's Antarctic Expedition: Ernest **Gourdon.**—The presence of neon amongst the gases from some hot springs: Charles **Moureu** and Robert **Biquard.** Previous notes published on the gases from twenty-two hot springs have shown the general presence of argon and helium. A direct examination of these gases for neon gave negative results, owing to the fact that the neon spectrum is completely masked by argon. By the application of the selective absorption of charcoal cooled to −100° C., neon was proved to be present in every case.—The cyanogenetic principles of *Phaseolus lunatus*: M. **Kohn-Abrest.**—The estimation of malic acid and some fixed acids in the juices of fruits, fermented or unfermented: W. **Mestrezat.** The method is based on the insolubility of barium malate, tartrate, and succinate in dilute alcohol.—The phospho-humic compounds of soil: J. **Dumont.**—Remarks concerning the artificial development of *Ascaris vitulorum*: L. **Jammes** and A. **Martin.**—The histological composition of the lymph of ruminants: E. **Forgeot.**—The pigmentation of hair and beard by the X-rays: A. **Imbert** and H. **Marquès.** Light hair darkens under the action of the X-rays.—The geology between Zinder and Tchad: René **Chudeau.**

CALCUTTA.

Asiatic Society of Bengal, July 4.—Some freshwater Entomostraca in the collection of the Indian Museum, Calcutta: R. **Gurney.** An account of the freshwater phyllopods, cladocera, and copepods in the collection of the Indian Museum. Fourteen species new to the Indian fauna are recorded; new species of Daphnia and Estheria, and a new variety of a Streptocephalus are described.—Preliminary note on the chemical examination of the milk and butter-fat of the Indian buffalo: E. R. **Watson.** Pappel and Richmond found that the milk of the Egyptian buffalo contains no lactose, but a different sugar that they name tewfikose. This is not the case with the milk of the Indian buffalo, which contains lactose. In the butter-fat the Indian buffalo's milk proves to contain more butyric acid than either the European cow or the Egyptian buffalo, and also apparently more palmitic or stearic acid.—A new gecko from the eastern Himalayas: Dr. N. **Annandale.** A description of a new form of Gymnodactylus closely allied to the Malayan *G. marmoratus*.—Freshwater fauna of India, No. viii., some Himalayan tadpoles: Dr. N. **Annandale.** The larvæ of *Bufo himalayanus* and *Rana liebigii* are described, and that of *Megalophrys montana* is recorded from the Darjeeling district. Notes are given on the different ways in which different tadpoles which inhabit mountain torrents in the Himalayas are protected against sudden floods.—A parasite upon a parasite. A Viscum—apparently *V. articulatum*—on *Loranthus vestitus* on *Quercus incana*: I. H. **Burkill.** The paper gives an account of the double parasitism recorded in the title together with a review of the geographical distribution of such double parasitism and the names of the associated plants in recorded cases.—Gentianacearum species Asiaticas novas descripsit I. H. **Burkill.** Diagnoses of new species of the genera Gentiana and Swertia from Asia.—Swertiam novam Japonicam ex affinitate Swertiæ tetrapteræ, Maxim., descripserunt S. le M. **Moore** and I. H. **Burkill.** Diagnosis of a new Swertia from Japan.

CONTENTS.